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Subject: Modifications to AFE Boards to allow for single-sided XING clock

Introduction

SVX Sequencer backplanes are crowded beasts, and changing cable connections can be difficult. One particular hazard is that of breaking individual pins. In December, 2002, one backplane was damaged during a detector access. One pin of one slot was broken. The two AFE boards connected to that Sequencer stopped working because one leg of the differential XING signal (7.6 MHz fixed clock) was broken. Rather than undertake the lengthy task of replacing the backplane, the two AFE boards were modified to work with a single-ended XING clock.

This document describes the particular changes made to those two AFE boards.

Circuit Description

The XING clock is sent to the AFE board as a differential TTL signal. A 75ALS190 driver is connected to two wires in the cable. A DS90C402 LVDS receiver is used by the AFE. The LVDS receiver is chosen because of its good bandwidth, high sensitivity and reasonable common-mode rejection. Figure 1 shows the circuit schematically.

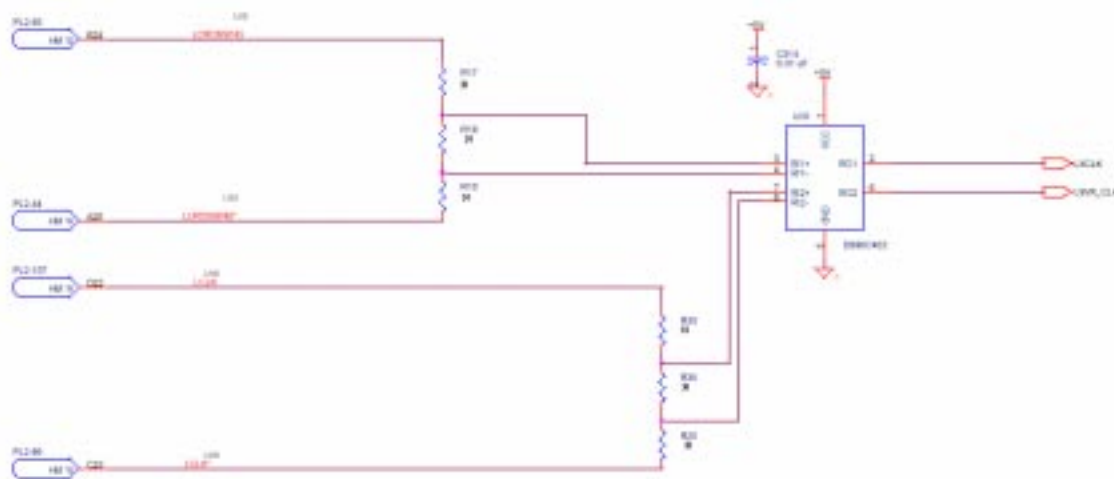


Figure 1

The XING signal, just like the SVX clock, is terminated by three 51 ohm resistors. The series combination provides the termination and the three-resistor set attenuates the signal so as to not overdrive the LVDS receiver. Not ideal, but it works. Were I to do it again I would have used four resistors (51 – 33 – 33 – 51) and put a capacitor of 0.01uF from the centerpoint to GND.

Modifications

To change the circuit for single-ended operation, the '-' input of the LVDS receiver (pin 4) is disconnected from the input by desoldering and lifting the pin in the air. Two new resistors of 2.2K and 3.3K are connected in series from +5V to GND to create a voltage divider generating 2V at the centerpoint. Pin 4 is connected to this 2V reference. The '+' half of the differential signal is reterminated by removing the 51 ohm resistor connected to the '-' half of the XING signal and the center resistor. One of the removed 51ohm resistors is then soldered from the '-' input to GND, creating an 102 ohm termination and signal divider. The new effective circuit is shown in Figure 2.

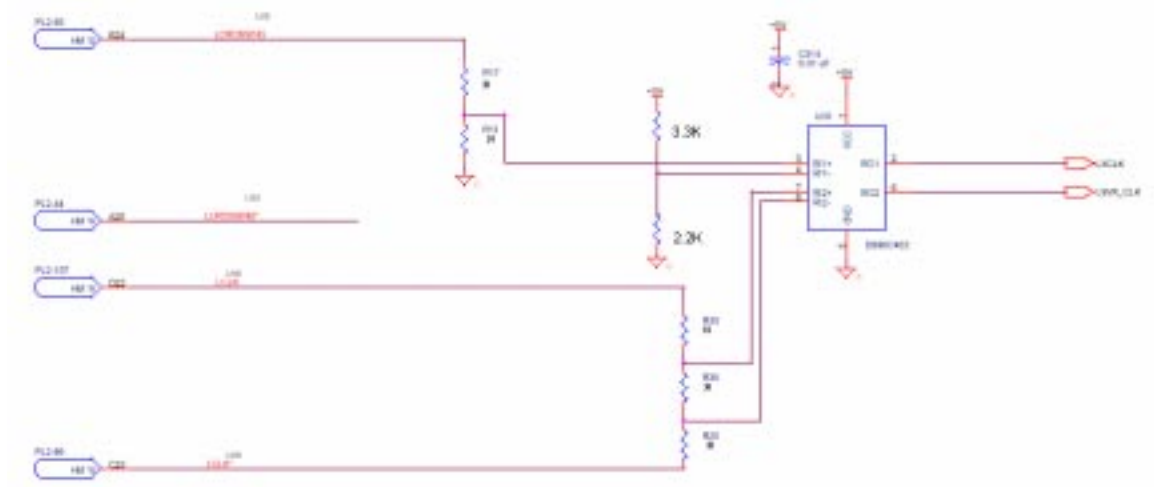


Figure 2

Operational Considerations

No special considerations are necessary. Although the lack of a differential signal decreases the noise immunity somewhat, operational experience has shown that the single-ended signal is of sufficient amplitude. The only worry might be that boards modified in this way may have an XING signal that is slightly less wide than the usual board.

Test Procedure

Boards modified in this way test like normal boards and require no special cabling or software. The oscilloscope should be used to insure that a single-ended board does not exhibit a shortened XING pulse as seen at pin 1 of U19 (normal XING test point). If the XING clock is too narrow, the 53 MHz and/or 61MHz PLLs may fail to lock. This would be caught in normal tests.